Claims

1. A method for the heat treatment of solids containing iron oxide, in which fine-grained solids are heated to a temperature of about 450 to 950°C in a fluidized-bed reactor (1), **characterized in that** a first gas or gas mixture is introduced from below into a mixing chamber region (7) of the reactor (1) through a preferably central gas supply tube (3), the gas supply tube (3) being at least partly surrounded by a stationary annular fluidized bed (10) which is fluidized by supplying fluidizing gas, and that the gas velocities of the first gas or gas mixture and of the fluidizing gas for the annular fluidized bed (10) are adjusted such that the Particle-Froude-Numbers in the gas supply tube (3) are between 1 and 100, in the annular fluidized bed (10) between 0.02 and 2, and in the mixing chamber (7) between 0.3 and 30.

2. The method as claimed in claim 1, **characterized in that** the Particle-Froude-Number in the gas supply tube (3) is between 1.15 and 20, in particular about 10.6.

3. The method as claimed in claim 1 or 2, **characterized in that** the Particle-Froude-Number in the annular fluidized bed (10) is between 0.115 and 1.15, in particular about 0.28.

4. The method as claimed in any of the preceding claims, **characterized in that** the Particle-Froude-Number in the mixing chamber (7) is between 0.37 and 3.7, in particular about 1.1.

5. The method as claimed in any of the preceding claims, **characterized in that** the bed height of solids in the reactor (1) is adjusted such that the annular fluidized bed (10) at least partly extends beyond the upper orifice end of the gas supply tube (3) and that solids are constantly introduced into the first gas or gas mixture and are entrained by the gas stream to the mixing chamber (7) located above the orifice region of the gas supply tube (3).

6. The method as claimed in any of the preceding claims, **characterized in that** iron-oxide-containing ore, in particular iron ore or iron ore concentrate is used as starting material.

7. The method as claimed in any of the preceding claims, **characterized in that** the fluidizing gas introduced into the annular fluidized bed (10) of the reactor (1) is a preheated reduction gas which contains at least 80 %, in particular more than 90 % hydrogen.

8. The method as claimed in claim 7, **characterized in that** the reduction gas is cleaned in a reprocessing stage (31, 32, 33, 34, 35) downstream of the reactor (1) and is subsequently recirculated to the reactor (1).

9. The method as claimed in any of the preceding claims, **characterized in that** downstream of the reactor (1) another fluidized-bed reactor (23) is provided, whose exhaust gases are separated from solids in a separator (27) and are introduced into the gas supply tube (3) of the reactor (1).

10. The method as claimed in any of the preceding claims, **characterized in that** upstream of the reactor (1) at least one preheating stage (12, 13, 14, 15) is provided for heating the solids.

11. A plant for the heat treatment of solids containing iron oxide, in particular for performing a method as claimed in any of claims 1 to 10, comprising a reactor (1) constituting a fluidized bed reactor, **characterized in that** the reactor (1) has a gas supply system which is formed such that gas flowing through the gas supply system entrains solids from a stationary annular fluidized bed (10), which at least partly surrounds the gas supply system, into the mixing chamber (7).

12. The plant as claimed in claim 11, **characterized in that** the gas supply system has at least one gas supply tube (3) which extends upwards substantially vertically from the lower region of the reactor (1) into a mixing chamber (7) of the reactor (1), the gas

supply tube (3) being at least partly surrounded by an annular chamber in which the stationary annular fluidized bed (10) is formed.

13. The plant as claimed in claim 12, **characterized in that** the gas supply tube (3) is arranged approximately centrally with reference to the cross-sectional area of the reactor (1).

14. The plant as claimed in any of claims 11 to 13, **characterized in that** the gas supply tube (3) has openings, for instance in the form of slots, at its shell surface.

15. The plant as claimed in any of claims 11 to 14, **characterized in that** a cyclone (9) for separating solids is provided downstream of the reactor (1), and that the cyclone (9) has a solids conduit (22) leading to the annular fluidized bed (10) of the reactor (1).

16. The plant as claimed in any of claims 11 to 15, **characterized in that** in the annular chamber of the reactor (1) a gas distributor (5) is provided, which divides the chamber into an upper fluidized bed region (10) and a lower gas distributor chamber (4), and that the gas distributor chamber (4) is connected with a supply conduit (6) for fluidizing gas.

17. The plant as claimed in any of claims 11 to 16, **characterized in that** the reactor (1) has a supply conduit for hydrogen-containing reduction gas, which leads to the gas supply tube (3) and is connected for instance with the exhaust gas outlet of a separator (27) of another reactor (23) downstream of the reactor (1), and/or has a supply conduit for preheated hydrogen-containing reduction gas, which leads to the annular chamber.

18. The plant as claimed in any of claims 11 to 17, **characterized in that** a preheating stage (12, 13, 14, 15) for the solids is provided upstream of the reactor (1).